

REMARKS

An excess claim fee payment letter is submitted herewith for three (3) excess claims and three (3) excess independent claims.

Claims 1-23 are all the claims presently pending in the application. Claims 1-3 and 6-9 have been amended to more particularly define the invention. Claims 10-23 have been added to claim additional features of the invention and to provide more varied protection for the invention.

It is noted that the claim amendments are made only for more particularly pointing out the invention, and not for distinguishing the invention over the prior art, narrowing the claims or for any statutory requirements of patentability.

Further, Applicant specifically states that no amendment to any claim herein should be construed as a disclaimer of any interest in or right to an equivalent of any element or feature of the amended claim.

Claims 1-9 stand rejected upon informalities (e.g., 35 U.S.C. § 112, second paragraph), and claims 1, 3-5, 8 and 9 stand rejected on prior art grounds. With respect to the prior art rejections, claims 1, 3-5, 8 and 9 stand rejected under 35 U.S.C. §102(b) as being anticipated by Ito, et al. (U.S. Patent No. 5,786,594; hereinafter "Ito").

These rejections are respectfully traversed in the following discussion.

I. THE CLAIMED INVENTION

The claimed invention is directed to a two-dimensional beam writing position detecting device and an image forming apparatus using the detecting device.

In an illustrative, non-limiting embodiment of the invention as defined by independent claim 1, a two-dimensional beam writing position detecting device includes an optical system for scanning on a photoconductor by laser beams emitted from a semiconductor laser to form an electrostatic latent image and arranging a plurality of the laser beams in two dimensions and slantingly scanning the plurality of laser beams for forming the electrostatic latent image on the photoconductor at a predetermined angle (θ). The detecting device also includes a detector for

detecting the plurality of laser beams for determining a first writing position of the plurality of laser beams on the photoconductor. A longitudinal direction of a light beam receiving surface of the detecting device inclines at the substantially same angle (θ_1) as the slant scanning angle (θ) with respect to the perpendicular of a scanning direction of the plurality of laser beams.

In yet another illustrative, non-limiting embodiment, a two-dimensional beam writing position detecting device includes an optical system for scanning on a photoconductor by laser beams emitted from a semiconductor laser to form an electrostatic latent image and arranging a plurality of the laser beams in two dimensions and slantingly scanning the plurality of laser beams for forming the electrostatic latent image on the photoconductor at a predetermined angle (θ), and a detector for detecting the plurality of laser beams for determining a first writing position of the plurality of laser beams on the photoconductor. A signal of a scanning direction beam of a first row or a plurality-th row detected by a light beam receiving surface of the detecting device is formed into a writing position signal on the photoconductor of the scanning direction beam of the first row. A writing position signal on the photoconductor of the scanning direction beam of a second or subsequent row is formed into a signal in which a delay or lead is provided so that a scanning direction writing position on the photoconductor of the second or subsequent row aligns with the writing position signal on the photoconductor of the scanning direction beam of the first row.

Conventional detecting devices suffer from a problem that the beams of the second and subsequent rows overlap the beam of the first row with respect to a sub-scanning direction, even when a slit is provided for the detecting device. Such overlapping in conventional detecting devices causes problems in detecting the positions of the original beams. Thus, the writing positions of the beams become unstable.

The claimed invention, on the other hand, has the advantage that the positions of the beams can be aligned on the photoconductor in the sub-scanning direction. As another advantage, the writing signals of each beam of a two-dimensional semiconductor laser for performing multiple scanning can be split by a single beam detector to determine a writing position on a photoconductor, thereby reducing manufacturing costs in comparison with conventional devices.

II. THE PRIOR ART REFERENCE (ITO)

Ito discloses a system for automatically adjusting or selecting a pitch between beams in a multi-beam scanning system. An array of light sources is mounted on a rotatable housing and emits light in a direction perpendicular to the rotational plane.

The system measures a pitch on or near an intermediate image-forming surface. Particularly, an opaque cover (e.g., 66) is placed over a photosensor (e.g., 66). The opaque cover includes an opening which may consist of two slits at angles θ_1 and θ_2 with respect to the sub-scanning direction of the beams. As such, each of the beams LS1, LS2, LS3 travels a different distance over the portions of the photosensor that are exposed by the openings at the same velocity. The amount of time for each beam to travel over the photosensor differs.

The photosensors detect the arrival of each beam at the photosensors, as disclosed at col. 10, lines 39-47, and Figure 14 of Ito, and the time differential of each beam's arrival at the photosensors is determined. This time differential is used to measure the pitch of the beams. In response to the measured pitch, the scanning and sub-scanning pitch are automatically adjusted or selected by rotating a housing unit to maintain a desired pitch.

III. CLAIM REJECTION BASED ON PRIOR ART GROUNDS

The Examiner rejects claims 1, 3-5, 8, and 9 under 35 U.S.C. § 102(b) as being anticipated by Ito. For at least the following reasons, Applicant respectfully traverses this rejection.

Independent claim 1 recites, *inter alia*, a two-dimensional beam writing position detecting device, comprising:

an optical system for scanning on a photoconductor by laser beams emitted from a semiconductor laser to form an electrostatic latent image and arranging a plurality of the laser beams in two dimensions and slantingly scanning the plurality of laser beams for forming the electrostatic latent image on the photoconductor at a predetermined angle (θ); and

a detector for detecting the plurality of laser beams for determining a first writing position of the plurality of laser beams on the photoconductor, wherein a longitudinal direction of a light beam receiving surface of the detecting device inclines at the substantially same angle (θ) as the

slant scanning angle (θ) with respect to the perpendicular of a scanning direction of the plurality of laser beams. (Emphasis added.)

The Examiner takes the position that Ito discloses all of the features of claim 1. Particularly, the Examiner alleges that Ito discloses a detector 66 for detecting the laser beams, wherein a longitudinal direction of a light beam receiving surface SL2 of the detecting device inclines at substantially the same angle as the slant scanning angle. The Examiner cites Figures 11A and 21 to support his position. Applicant respectfully disagrees with the Examiner's position for several reasons.

Contrary to the Examiner's position, Ito does not disclose or suggest that angles θ_1 and θ_2 are substantially the same angle as the slant scanning angle of the laser beams, as recited in claim 1. For example, as set forth above, Ito discloses an opaque cover on the photosensor (e.g., 66) that includes two slits at angles θ_1 and θ_2 with respect to the sub-scanning direction of the beams, as shown in Figure 21.

However, Ito does not disclose, suggest, or ever mention comparing the angles θ_1 and θ_2 to the slant angle of the laser beams. In fact, only Figure 37 of Ito appears to define the slant angle of the laser beams and, in doing so, defines these angles as α and β (see col. 21, lines 13-18). Thus, the predetermined angles θ_1 and θ_2 in Ito are not substantially equal the slant angles α or β of the laser beams, nor is there any disclosure or suggestion in Ito that these angles should be substantially the same.

Instead, Ito discloses that angles θ_1 and θ_2 are not substantially the same as the slant angle of the beams because the beams arrive at the slits at different times. That is, since the beams travel across the photosensor at the same velocity and are parallel to each other, the beams would not appear to be able to arrive at the slits of the photosensor at different times (as disclosed by Ito) unless the angles θ_1 and θ_2 were not the same as the slant angle of the beams. Thus, the predetermined angles θ_1 and θ_2 of Ito clearly are not comparable to angles θ_1 and θ of the present invention.

For at least the foregoing reasons, Applicant respectfully submits that Ito merely discloses that the time differential of the beams traveling over the photosensor is used to measure the pitch

of the beams, which is then used to adjust the scanning and sub-scanning pitch by rotating a housing unit to maintain a desired pitch.

The Ito reference does not, however, disclose or suggest that “a longitudinal direction of a light beam receiving surface of the detecting device inclines at the substantially same angle (θ_1) as the slant scanning angle (θ) with respect to the perpendicular of a scanning direction of the plurality of laser beams,” as recited in claim 1. Thus, claim 1 would not have been anticipated or, for that matter, rendered obvious by Ito.

As for claims 2-6 and 8, Applicant submits that claims 2-6 and 8 are patentable at least by virtue of their dependency from claim 1, as well as by virtue of the additional features recited therein.

IV. THE 35 USC §112, SECOND PARAGRAPH REJECTION

Claims 1-9 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. The claims have been amended, above, to overcome this rejection. Specifically, claims 1-3 and 6-9 have been amended to provide proper antecedent basis and to clarify and define more clearly the features of the present invention.

With respect to claim 6, it is alleged that claim 6 is indefinite because the claimed “plurality-th row” is unclear. Applicant respectfully disagrees. The “plurality-th row” is merely an alternative way of saying the n^{th} row. A person of skill in the art clearly would know what is meant by the “plurality-th row” or the n^{th} row. Thus, Applicant requests that the Examiner withdraw this rejection.

Claims 6 and 7 were not examined on the merits, since the intended subject matter of these claims was deemed to be unclear by the Examiner. However, Applicant respectfully submits that claim 6 is patentable over Ito at least by virtue of its dependency from claim 1, as well as based on the additional features recited therein.

With respect to independent claim 7, Applicant submits that claim 7 is patentable over Ito because Ito does not disclose or suggest all of the recitations of this claim. For example, claim 7 recites, *inter alia*,

a writing position signal on the photoconductor of the scanning
direction beam of a second or subsequent row is formed into a signal in

which a delay or lead is provided so that a scanning direction writing position on the photoconductor of the second or subsequent row aligns with a scanning direction writing position on the photoconductor of the first row obtained by the writing position signal of the scanning direction beam of the first row. (Emphasis added.)

It clearly does not disclose or suggest at least this feature, and therefore, does not anticipate, or render obvious, claim 7.

V. NEW CLAIMS

Claims 10-23 are added to provide more varied protection for the invention. Claims 10-23 are patentable at least for reasons similar to those set forth above.

VI. FORMAL MATTERS AND CONCLUSION

Figure 2 is amended merely to correct minor spelling errors. The Examiner is requested to acknowledge receipt of and approve the attached corrected Drawings.

In view of the foregoing, Applicant submits that claims 1-23, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

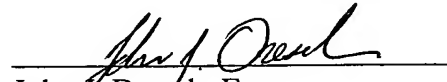
Serial No. 10/085,583
Docket No. H07-139239M/MNN

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The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: March 8, 2004



John J. Dresch, Esq.
Registration No. 46,672

Sean M. McGinn
Registration No. 34,386

McGinn & Gibb, PLLC
8321 Old Courthouse Road, Suite 200
Vienna, VA 22182-3817
(703) 761-4100
Customer No. 21254



FIG.2

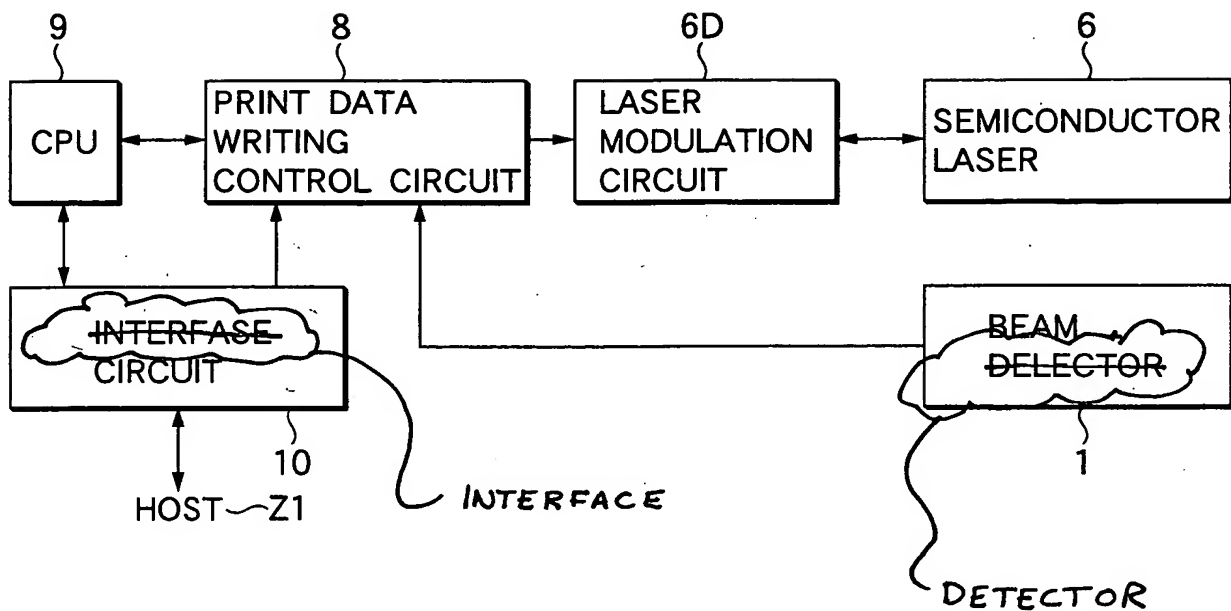


FIG.3

